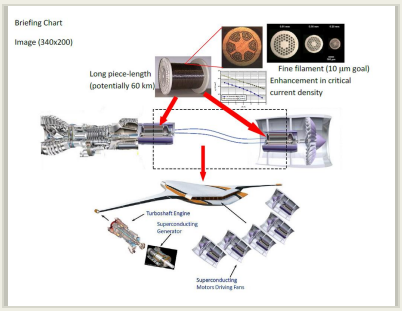
Small Business Innovation Research/Small Business Tech Transfer

Fine-Filament Magnesium Diboride Superconductor Wire for Turboelectric Propulsion Systems, Phase II

Completed Technology Project (2014 - 2019)

Project Introduction

This SBIR Phase II proposal overcomes technology barriers for developing highly efficient all electric aircraft systems for the future, with limited impact to the environment. Turboelectric propulsion for aircraft applications is envisioned, and cryogenic and superconducting components are sought. In particular, low AC loss superconducting wires for the stator windings and superconducting wires with filaments less than 10 micrometers in diameter are of interest. There is an intense push in the aircraft industry to ultimately develop an all-electric aircraft, with liquid hydrogen and fuel cells being considered as the prime generation source for aircraft propulsion. The U.S. is in competition with Europe for the development the next generation all-electric aircraft. Superconductivity especially magnesium diboride (MgB2) superconductors are considered an enabling technology that is being investigated by NASA, Air Force, Rolls-Royce, Airbus and EADS. This means the need for a low cost, low AC loss (fine filament superconductor) that can operate in the 10-25K temperature range in 0-2 tesla fields for superconducting stators for motors and generators. This wire is need by 2016-2017 time frame so all cryogenic motors and generators can fabricated and tested in the NASA test bed. In the Phase I Hyper Tech has shown that fine filament MgB2 wires can be fabricated and there is potential for low AC losses in the 60-400 Hz range for stators. In the Phase II Hyper Tech will continue to work on developing, manufacturing, and testing fine filament MgB2 wire. The wires will also be twisted to reduce coupling losses. The wires will be tested for their superconductor and engineering current density and AC losses. The result of this work will be a low AC loss MgB2 superconductor wire for enabling all-electric aircraft development and allow the U.S. industry to lead the world in this needed and rapid developing technology.



FINE-FILAMENT MAGNESIUM DIBORIDE SUPERCONDUCTOR WIRE FOR TURBOELECTRIC PROPULSION SYSTEMS, Phase II

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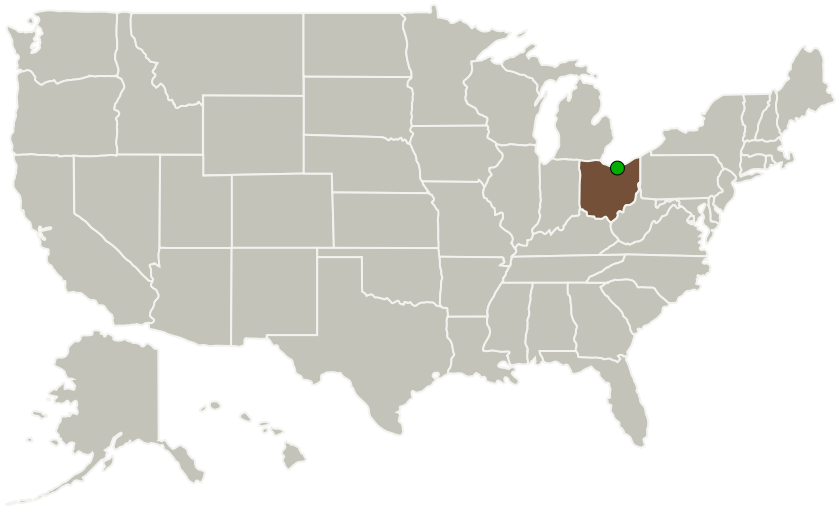
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Hyper Tech Research, Inc.	Lead Organization	Industry	Columbus, Ohio
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations
Ohio

Project Transitions

April 2014: Project Start

August 2019: Closed out

Closeout Summary: FINE-FILAMENT MAGNESIUM DIBORIDE SUPERCONDUCT OR WIRE FOR TURBOELECTRIC PROPULSION SYSTEMS, Phase II Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/137622)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Hyper Tech Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Matthew Rindfleisch

Co-Investigator:

Matthew Rindfleisch

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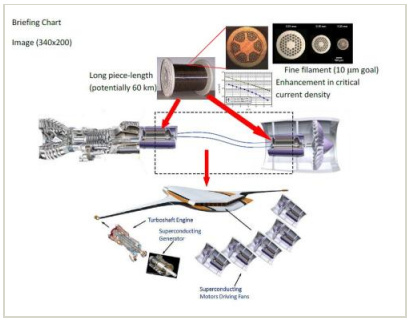
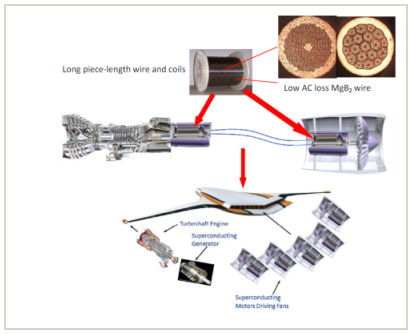
Images



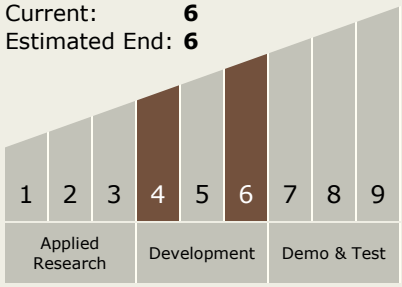
Briefing Chart Image
FINE-FILAMENT MAGNESIUM DIBORIDE SUPERCONDUCTOR WIRE FOR TURBOELECTRIC PROPULSION SYSTEMS, Phase II
(https://techport.nasa.gov/image/131826)



Final Summary Chart Image
FINE-FILAMENT MAGNESIUM DIBORIDE SUPERCONDUCTOR WIRE FOR TURBOELECTRIC PROPULSION SYSTEMS, Phase II Project Image
(https://techport.nasa.gov/image/133140)

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System